

# Sebastián Alejandro Díaz Santiago

Postdoctoral Associate UNIVERSITY OF DUISBURG-ESSEN  
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## RESEARCH INTERESTS

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### Theoretical Condensed Matter Physics:

- Electronic and Spin Transport Phenomena
- Magnetic Skyrmions
- Majorana Bound States
- Nanoscale Magnetism & Superconductivity
- Topological Magnonics
- Topological Superconductivity

## PUBLICATIONS

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Nature Communications (1), Nano Letters (1), Physical Review Letters (4), Physical Review B (4)

- [16] "Steering Majorana braiding via skyrmion-vortex pairs: A scalable platform," J. Nothhelfer, **S. A. Díaz**, S. Kessler, T. Meng, M. Rizzi, K. M. D. Hals, and K. Everschor-Sitte, [Physical Review B](#) **105**, 224509 (2022).
- [15] "Observation of fractional spin textures in a Heusler material," J. Jena, B. Göbel, T. Hirosawa, **S. A. Díaz**, D. Wolf, T. Hinokihara, V. Kumar, I. Mertig, C. Felser, A. Lubk, D. Loss, and S. S. P. Parkin, [Nature Communications](#) **13**, 2348 (2022).
- [14] "Laser-Controlled Real- and Reciprocal-Space Topology in Multiferroic Insulators," T. Hirosawa, J. Klinovaja, D. Loss, and **S. A. Díaz**, [Physical Review Letters](#) **128**, 037201 (2022); [[Journal Cover](#)].
- [13] "Majorana bound states induced by antiferromagnetic skyrmion textures," **S. A. Díaz**, J. Klinovaja, D. Loss, and S. Hoffman, [Physical Review B](#) **104**, 214501 (2021).
- [12] "Der Quanten-Twist," **S. A. Díaz** and K. Everschor-Sitte, [Physik Journal](#) **20** (2021) Nr. 11.
- [11] "Quantum Nucleation of Skyrmions in Magnetic Films by Inhomogeneous Fields," **S. A. Díaz** and D. P. Arovas, [Memorial Volume for Shoucheng Zhang](#), pp. 19-33 (2021).
- [10] "Chiral hinge magnons in second-order topological magnon insulators," A. Mook, **S. A. Díaz**, J. Klinovaja, and D. Loss, [Physical Review B](#) **104**, 024406 (2021).
- [9] "Magnonic Quadrupole Topological Insulator in Antiskyrmion Crystals," T. Hirosawa, **S. A. Díaz**, J. Klinovaja, and D. Loss, [Physical Review Letters](#) **125**, 207204 (2020).
- [8] "Spin Wave Radiation by a Topological Charge Dipole," **S. A. Díaz**, T. Hirosawa, D. Loss, and C. Psaroudaki, [Nano Letters](#) **20**, 6556 (2020).
- [7] "Chiral magnonic edge states in ferromagnetic skyrmion crystals controlled by magnetic fields," **S. A. Díaz**, T. Hirosawa, J. Klinovaja, and D. Loss, [Physical Review Research](#) **2**, 013231 (2020).
- [6] "Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals," **S. A. Díaz**, J. Klinovaja, and D. Loss, [Physical Review Letters](#) **122**, 187203 (2019); [[Journal Cover](#)].
- [5] "Avalanches and Criticality in Driven Magnetic Skyrmions," **S. A. Díaz**, C. Reichhardt, D. P. Arovas, A. Saxena, and C. J. O. Reichhardt, [Physical Review Letters](#) **120**, 117203 (2018).
- [4] "Fluctuations and noise signatures of driven magnetic skyrmions," **S. A. Díaz**, C. J. O. Reichhardt, D. P. Arovas, A. Saxena, and C. Reichhardt, [Physical Review B](#) **96**, 085106 (2017).
- [3] "Controlling skyrmion helicity via engineered Dzyaloshinskii-Moriya interactions," **S. A. Díaz** and R. E. Troncoso, [Journal of Physics: Condensed Matter](#) **28**, 426005 (2016).
- [2] "The role of measurement time on the universal crossover from 1/f to non-1/f noise behavior," **S. A. Díaz** and M. Di Ventra, [Journal of Computational Electronics](#) **14**, 203 (2015).
- [1] "Current-induced exchange interactions and effective temperature in localized moment systems," **S. A. Díaz** and A. S. Núñez, [Journal of Physics: Condensed Matter](#) **24**, 116001 (2012); [[Journal Cover](#)].

## INVITED TALKS

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- May 6** “Magnetic Skyrmions Induce Topological Superconductivity”  
**2022** UNIVERSITY OF DUISBURG-ESSEN  
Duisburg, Germany.
- April 11** “Correlated Dynamics of Driven Magnetic Skyrmions”  
**2022** MAX BORN INSTITUTE FOR NONLINEAR OPTICS AND SHORT PULSE SPECTROSCOPY  
Berlin, Germany.
- September 28** “Magnetic Skyrmions as Topological Multi-Media Influencers”  
**2021** *DPG Meeting “SKM 2021”*  
Virtual Conference.
- August 6** “Skyrmiones Magnéticos” (in Spanish)  
**2021** *Physics Seminar*  
FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS, UNIVERSIDAD DE CHILE  
Santiago, Chile.
- July 3** “Topological Magnonic Edge and Corner States in Skyrmion Crystals”  
**2020** ONLINE SPINTRONICS SEMINAR SERIES  
USA.
- June 3** “Magnonic Quadrupole Topological Insulator in Antiskyrmion Crystals”  
**2020** MAX PLANCK INSTITUTE OF MICROSTRUCTURE PHYSICS  
Halle (Saale), Germany.
- February 17** “Skyrmion Crystals as Topological Magnonics Platforms”  
**2020** KARLSRUHE INSTITUTE OF TECHNOLOGY (KIT)  
Karlsruhe, Germany.
- September 30 -** “Skyrmion Crystals as Topological Magnonic Platforms”  
**October 3** *Topomagnetism is Coming, Young Research Leaders Group Workshop,*  
**2019** JGU HELMHOLTZ-INSTITUT  
Mainz, Germany.
- May 14** “Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals”  
**2019** UNIVERSITY OF BASEL  
Basel, Switzerland.
- April 3** “Magnon Transport and Magnonic Topological Insulators”  
**2019** *DPG Spring Meeting*  
Regensburg, Germany.
- February 6 - 8** “Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals”  
**2019** *QSIT General Meeting*  
Arosa, Switzerland.
- October 9** “Skyrmion Crystals as Topological Magnonics Platforms”  
**2018** CENTER FOR QUANTUM SPINTRONICS (QUSPIN), NTNU  
Trondheim, Norway.
- October 30** “Magnetic Skyrmions: Quantum Nucleation and Current-Driven Dynamics”  
**2017** *Condensed Matter Physics Seminar*  
FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS, UNIVERSIDAD DE CHILE  
Santiago, Chile.
- September 8** “Searching for novel noise signatures in transport measurements of magnetic skyrmions”  
**2016** *CNLS Student Seminar*  
LOS ALAMOS NATIONAL LABORATORY  
Los Alamos, NM, USA.

## CONTRIBUTED TALKS

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- September 4 - 9  
2022** “Steering Majorana Braiding via Skyrmion-Vortex Pairs: A Scalable Platform”  
*DPG Meeting 2022*  
Regensburg, Germany.
- August 31  
2022** “Steering Majorana Braiding via Skyrmion-Vortex Pairs: A Scalable Platform”  
*Around-the-Clock Around-the-Globe Magnetism Conference 2022*  
Virtual Conference.
- August 28 - September  
2  
2022** “Steering Majorana Braiding via Skyrmion-Vortex Pairs: A Scalable Platform”  
*12<sup>th</sup> International Conference on Magnetic and Superconducting Materials (MSM22)*  
Duisburg, Germany.
- June 27 - July 1  
2022** “Steering Majorana Braiding via Skyrmion-Vortex Pairs: A Scalable Platform”  
*Sol-SkyMag 2022*  
San Sebastian, Spain.
- March 14 - 18  
2022** “Steering Majorana Braiding via Skyrmion-Vortex Pairs: A Scalable Platform”  
*2022 American Physical Society March Meeting*  
Chicago, IL, USA.
- January 10 - 14  
2022** “Laser-Controlled Real and Reciprocal Space Topology in Multiferroic Insulators”  
*15<sup>th</sup> Joint MMM-INTERMAG Conference*  
New Orleans, LA, USA.
- January 5 - 7  
2022** “Steering Majorana Braiding via Skyrmion-Vortex Pairs: A Scalable Platform”  
*Non-Linear Magnetism, WE-Heraeus-Seminar*  
Bad Honnef, Germany.
- October 13 - 15  
2021** “Steering Majorana Braiding via Skyrmion-Vortex Pairs”  
*SPP2137 Skyrmionics Retreat*  
Bad Honnef, Germany.
- September 27 -  
October 1  
2021** “Majorana Bound States Induced by Antiferromagnetic Skyrmion Textures”  
*DPG Meeting “SKM 2021”*  
Virtual Conference.
- September 6 - 10  
2021** “Majorana Bound States Induced by Antiferromagnetic Skyrmion Textures”  
*VI International Workshop Dzyaloshinskii-Moriya Interaction and Exotic Spin Structures*  
Vyborg, Russia.
- September 6 - 10  
2021** “Chiral Hinge Magnons in Second-Order Topological Magnon Insulators”  
*Trends in MAGnetism 2021*  
Cefalù, Palermo, Italy.
- June 28 - July 2  
2021** “Chiral Hinge Magnons in Second-Order Topological Magnon Insulators”  
*The European Conference Physics of Magnetism 2021*  
Poznań, Poland.
- June 21 - 24  
2021** “Topological Phase Transition Controls Magnon Spin Currents”  
*Sol-SkyMag 2021*  
San Sebastian, Spain.
- June 7 - 9  
2021** “Majorana Bound States Induced by Antiferromagnetic Skyrmion Textures”  
*Magnetic North VII, The Canadian Magnetism Conference Series*  
Virtual Conference.
- April 26 - 30  
2021** “Spin Wave Radiation by a Topological Charge Dipole”  
*INTERMAG 2021*  
Virtual Conference.
- April 15 - 20  
2021** “Majorana Bound States Induced by Antiferromagnetic Skyrmion Textures”  
*Korrelationstage 2021, Virtual Workshop*  
MAX PLANCK INSTITUTE FOR THE PHYSICS OF COMPLEX SYSTEMS,  
Dresden, Germany.
- March 15 - 19  
2021** “Chiral Hinge Magnons in Second-Order Topological Magnon Insulators”  
*2021 American Physical Society March Meeting*  
ONLINE.

- November 2 - 6  
2020** “Magnonic Quadrupole Topological Insulator in Antiskyrmion Crystals”  
*2020 Magnetism and Magnetic Materials Conference*  
Palm Beach, FL, USA.
- March 2  
2020** “Chiral Magnonic Edge States in Ferromagnetic Skyrmion Crystals Controlled by Magnetic Fields”  
*Mini March Meeting – Spintronics, Magnetism, and Magnetic Materials*  
Riverside, CA, USA.
- September 17 - 19  
2019** “Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals”  
*Skyrmionics Workshop For Young Researcher*  
JGU MITP,  
Mainz, Germany.
- August 29  
2019** “Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals”  
*Joint Annual Meeting SPS and ÖPG 2019*  
Zürich, Switzerland.
- July 28 - August 1  
2019** “Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals”  
*Magnonics 2019*  
Carovigno, Italy.
- June 24 - 28  
2019** “Topological Magnons and Edge States in Antiferromagnetic Skyrmion Crystals”  
*Sol-SkyMag 2019*  
San Sebastian, Spain.
- March 13 - 17  
2017** “Noise Fluctuations and Avalanche Statistics of Skyrmions with Quenched Disorder”  
*2017 American Physical Society March Meeting*  
New Orleans, LA, USA.
- March 14 - 18  
2016** “Controlling skyrmion helicity via engineered Dzyaloshinskii-Moriya interactions”  
*2016 American Physical Society March Meeting*  
Baltimore, MD, USA.
- January 11 - 15  
2016** “Skyrmion Nucleation via Localized Magnetic Fields”  
*13<sup>th</sup> Joint MMM-Intermag Conference*  
San Diego, CA, USA.

## CONFERENCES/WORKSHOPS/SCHOOLS

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- June 28 - July 1  
2021** *Topological Matter Conference 2021*  
Virtual Conference.
- May 3 - 5  
2021** *2D Materials for Spin-Orbitronics*  
*An ICTP Virtual Meeting*  
Trieste, Italy.
- March 31 - April 1  
2021** *SKYMAG 2021*  
Online Workshop.
- February 9 - 18  
2021** *1<sup>st</sup> Joint Workshop of CRC 1242 & TRR 227*  
*Exciting Dynamics: How electrons, spins, and phonons interact*  
Poster: “Spin Wave Radiation by a Topological Charge Dipole”
- December 7 - 11  
2020** *Joint European Magnetic Symposia*  
Lisbon, Portugal.  
Poster: “Spin Wave Radiation by a Topological Charge Dipole”
- November 3 - 6  
2020** *Young Research Leaders Group Workshop*  
*Spin, Charge, and Heat Transport: From Symmetries to Emergent Functionalities*  
SPICE Online Workshop.
- October 19 - 22  
2020** *Topological Superconductivity in Quantum Materials*  
SPICE Online Workshop.

- February 5 - 7  
2020** *QSIT General Meeting*  
Arosa, Switzerland.  
Poster: "Skyrmion Crystals as Topological Magnonics Platforms"
- December 1 - 5  
2019** *Skyrmions in Magnetic Materials, British-German WE-Heraeus-Seminar*  
Bad Honnef, Germany.  
Poster: "Skyrmion Crystals as Topological Magnonics Platforms"
- October 4 - 5  
2018** *Quantum Spintronics 2018*  
Trondheim, Norway.
- September 3 - 7  
2018** *Joint European Magnetic Symposia*  
Mainz, Germany.  
Poster: "Magnetic Skyrmion Avalanches"
- November 4 - 8  
2013** *58<sup>th</sup> Annual Conference on Magnetism and Magnetic Materials*  
Denver, CO, USA.
- March 18 - 22  
2013** *2013 American Physical Society March Meeting*  
Baltimore, MD, USA.
- July 6 - 24  
2009** *Summer College on Non-equilibrium Physics from Classical to Quantum Low Dimensional Systems*  
THE ABDUS SALAM INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS,  
Trieste, Italy.
- January 6 - 9  
2009** *II Escuela de Nanoestructuras (Summer School on Nanostructures)*  
UNIVERSIDAD TÉCNICA FEDERICO SANTA MARÍA,  
Valparaíso, Chile.
- January 4 - 6  
2009** *Workshop on Decoherence, Correlations and Spin Effects in Nanostructured Materials (MWN/CIAM),*  
Viña del Mar, Chile.  
Poster: "Slave boson method applied to a two sites chain coupled to reservoirs"
- December 9 - 12  
2008** *At the Frontiers of Condensed Matter IV (Current Trends and Novel Materials)*  
Buenos Aires, Argentina.  
Poster: "Shot noise and charge fluctuations in a double quantum dot chain"
- November 12 - 14  
2008** *XVI Simposio Chileno de Física*  
Valparaíso, Chile.  
Poster: "Shot noise and charge fluctuations in a double quantum dot chain"

## RECOGNITION & AWARDS

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- 2010 - 2013** Ph.D. scholarship awarded to a single applicant per country  
**International Fulbright Science and Technology Award** THE BUREAU OF EDUCATIONAL AND CULTURAL AFFAIRS OF THE U.S. DEPARTMENT OF STATE
- 2009 - 2010** Awarded to the top 3 applicants at the national level  
**Master's Degree Fellowship** CONICYT (Chilean Science and Technology National Research Committee)
- 2004 - 2007** Awarded to students with grades in the top 6%  
**Outstanding Student Recognition** Facultad de Ciencias Físicas y Matemáticas, UNIVERSIDAD DE CHILE
- 2004 - 2009** Second highest score in the 2003 national university admission process  
**Academic Excellence Scholarship** Full college tuition coverage  
EL MERCURIO S.A.P.

## RESEARCH EXPERIENCE & EDUCATION

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- Postdoctoral Associate** UNIVERSITY OF DUISBURG-ESSEN, 2021 - present  
Group of Prof. Dr. Karin Everschor-Sitte
- Postdoctoral Associate** JOHANNES GUTENBERG UNIVERSITY MAINZ, 2020 - 2021  
Group of Prof. Dr. Karin Everschor-Sitte
- Postdoctoral Associate** UNIVERSITY OF BASEL, 2017 - 2020  
Group of Prof. Dr. Daniel Loss
- Ph.D., Physics** UNIVERSITY OF CALIFORNIA, SAN DIEGO, 2017  
Supervisor: Prof. Daniel Arovas  
Dissertation: [“Toward Magnetic Skyrmion Manipulation”](#)
- Graduate Student Internship** LOS ALAMOS NATIONAL LABORATORY, June - December 2016  
Mentors: Dr. Cynthia J. O. Reichhardt, Dr. Charles Reichhardt, and Dr. Avadh Saxena
- M.S., Physics** UNIVERSIDAD DE CHILE, 2010  
Supervisor: Prof. Álvaro Núñez  
Thesis: [“Controlling spin interactions with electric currents”](#)
- B.S., Physics** UNIVERSIDAD DE CHILE, 2008

## TECHNIQUES & SKILLS

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- Theoretical** Bogoliubov-de Gennes Formalism  
Floquet-Magnus Expansion  
(Nested) Wilson Loops  
Holstein-Primakoff Method  
Collective Coordinates  
Stochastic Ordinary Differential Equations  
Instantons  
Keldysh Formalism  
Path Integrals  
Spin Coherent States
- Computer Simulations** Atomistic Spin Simulations  
Monte Carlo Methods  
Molecular Dynamics  
Stochastic Ordinary Differential Equations
- Programing and Software** C  
C++  
Mathematica  
L<sup>A</sup>T<sub>E</sub>X  
Adobe Illustrator

## TEACHING EXPERIENCE

*Teaching assistant of summer schools, undergraduate, and graduate physics courses (10-100 students per course).*  
*Instructor of record of undergraduate physics labs leading a team of head TA's and managing ~ 1100 students in total.*

- 2021 - 2022** TEACHING ASSISTANT,  
Undergraduate Physics Courses,  
Faculty of Physics, University of Duisburg-Essen
- 2018 - 2020** TEACHING ASSISTANT,  
Undergraduate and Graduate Physics Courses,  
Department of Physics, University of Basel
- 2013 - 2017** TEACHING ASSISTANT,  
Undergraduate and Graduate Physics Courses,  
Department of Physics, University of California, San Diego
- Spring 2016** INSTRUCTOR OF RECORD,  
Physics 1 Series Labs,  
Department of Physics, University of California, San Diego
- 2006 - 2008** TEACHING ASSISTANT,  
Undergraduate Physics Courses,  
Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile
- Summer 2006 & 2007** TEACHING ASSISTANT,  
Física I, Escuela de Verano (Physics Summer Course for high school students),  
Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile

## CO-SUPERVISION EXPERIENCE

- Ross Knapman, Ph.D. student, JOHANNES GUTENBERG UNIVERSITY MAINZ, 2021 - present
- Jonas Nothhelfer, Ph.D. student, JOHANNES GUTENBERG UNIVERSITY MAINZ, 2021 - present
- Lucas Görzen, Master's student, JOHANNES GUTENBERG UNIVERSITY MAINZ, 2021 - present
- Stephan Kessler, Master's student, JOHANNES GUTENBERG UNIVERSITY MAINZ, 2021 - 2022  
Master's Thesis: *Numerical simulation of quantum operations with Majorana bound states*
- Tomoki Hirose, Ph.D. student, UNIVERSITY OF TOKYO, 2019 - 2021
- Rhea Hoyer, Master's student, UNIVERSITY OF BASEL, 2020  
Master's Project: *Two-magnon bound states in one-dimensional magnets with Dzyaloshinskii-Moriya interaction*

## SCIENTIFIC COMMUNITY SERVICE

- Journal Reviewer** Science, Nature Reviews, Nature Communications, Physical Review B
- Conference Chair** *INTERMAG 2021, DPG Meeting "SKM 2021", SPP2137 Skymionics Retreat 2021*
- Young Researchers' Representative** SPP2137 Skymionics, 2021 - present
- Conference Organizer** *SPP2137 Skymionics Young Researchers' Retreat 2022*

## OUTREACH

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**December 14 - 20  
2013** "COACH-A-TEACHER" PROGRAM  
Workshops, lectures, and demonstrations for high school teachers and students.  
Santiago, Chile.

## PROFESSIONAL SOCIETIES

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- American Physical Society (member)

## PERSONAL REFERENCES

---

**Prof. Dr. Karin  
Everschor-Sitte** Faculty of Physics,  
University of Duisburg-Essen  
Lotharstraße 1, 47057 Duisburg, Germany  
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daniel.loss@unibas.ch

**Prof. Daniel P. Arovas** Department of Physics,  
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**Dr. Cynthia J. Olson  
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**Dr. Avadh Saxena** Theoretical Division and Center for Nonlinear Studies,  
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**Prof. Álvaro Núñez** Departamento de Física,  
Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile  
Blanco Encalada 2008, Santiago, Chile  
alnunez@dfi.uchile.cl